

**END OF SEMESTER EXAMINATIONS**

**2ND SEMESTER 2022/2023 ACADEMIC YEAR**

**DATE: JULY 2023**

**COURSE CODE: CVE 203**

**COURSE TITLE:PHYSICAL AND STRUCTURAL GEOLOGY**

**LECTURER’S NAME: MR THOMAS AKYEN**

**DURATION: 3 HOURS**

**APPENDICES**

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|  | **COURSE OUTLINE**  **(MAIN TOPICS)** | **QUESTION NO.** |
| **MajorTopic-1** | **Characterized of minerals** | Q1 |
| **MajorTopic-2** | **Compaction of civil engineering materials** | Q2 |
| **MajorTopic-3** | **Importance of sedimentary rocks in civil engineering** | Q3 |
| **MajorTopic-4** | **Concepts of physical geology** | Q4 |
| **MajorTopic-5** | **Occurrence of earthquakes in geological setting** | Q5 |
| **MajorTopic-6** | **Types of igneous rocks** | Q6 |
| **MajorTopic-7** | **Components of Soils** | Q7 |
| **MajorTopic-8** | **Played by an atom in the area of mineralogy** | Q8 |
| **MajorTopic-9** | **Rock types** | Q9 |
| **MajorTopic-10** | **Sediment properties** | Q8B |
| **MajorTopic-11** | **Importance of conglomerate in civil engineering.** | Q7B |
| **MajorTopic-12** | **Geological investigations** | Q8D |
| **MajorTopic-13** | **Importance of iron ore as economic benefit** | Q9B |
| **MajorTopic-14** | **Continental drift in physical and structural geology** | Q10 |
| **MajorTopic-15** |  |  |
| **………….** |  |  |

**PART A (UNDERSTANDING)**

**INSTRUCTIONS: Part A contains FIVE questions. Answer ALL questions.**

**Questions**

1. Minerals can be characterized by their physical properties. Some of the properties that can be used to characterize and identify minerals. Based on the characterization, how would you compare rocks in terms of?

I. Hardness

II. Cleavage

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| **Major Topic**  **Characterized of minerals** | **Blooms Designation**  **UN** | **Score**  **5** |

2. In a comparative analysis of the above, discuss in detail how compaction is done in order to carry out major construction projects such as a highway in a developing country.

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| **Major Topic**  **Compaction of civil engineering materials** | **Blooms Designation**  **UN** | **Score**  **5** |

3. Discuss in detail the importance of sedimentary rocks in civil engineering such as the construction of major projects in a developing country.

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| **Major Topic**  **Importance of sedimentary rocks in civil engineering** | **Blooms Designation**  **UN** | **Score**  **5** |

4. Geology is the study of the solid earth including its history, composition, internal structure, and surface features. Discuss the concepts of physical geology.

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| **Major Topic**  **Concepts of physical geology** | **Blooms Designation**  **UN** | **Score**  **5** |

**5.** Seismic performance is an execution of a building structure's ability to sustain its due functions, such as safety and serviceability, at and after a particular earthquake. Discuss the occurrence of earthquakes in the area of geological setting.

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| **Major Topic**  **occurrence of earthquakes in the area of geological setting** | **Blooms Designation**  **UN** | **Score.**  **5** |

**TOTAL SCORE: 25 MARKS**

**PART B[APPLICATION AND ANALYSIS]**

**INSTRUCTIONS: Part B contains THREE questions. Attempt any TWO questions.**

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**Question 6**

a) Igneous rocks are formed from solidification and cooling of magma. This magma can be derived from partial melts of pre-existing rocks in either a planet's mantle or crust. Typically, the melting of rocks is caused by one or more of three processes namely; an increase in temperature, a decrease in pressure, or a change in composition. Analyse extrusive and intrusive types of igneous rocks in the study of geology.

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| **Major Topic**  **Types of igneous rocks** | **Blooms Designation**  AP | **Score**  **6** |

b) An in-depth knowledge of geology enables the nature, formation, structure of soils and rocks and the ability to interpret the geological history of a site. Discuss the any three (3) importance of geology in civil engineering.

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| **Major Topic**  **Importance of geology in civil engineering** | **Blooms Designation**  **AN** | **Score**  **6** |

c) Physical geology uses the scientific method to explain natural aspects of the Earth-for example, how mountains form or why oil resources are concentrated in some rocks and not in others. This briefly explains how and why earth's surface, and its interior, is constantly changing. Discuss the following:

I. Geotectonics

II. Metamorphism

III. Magmatism

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| **Major Topic**  **Sub-branches of endogenous geology** | **Blooms Designation**  **AP** | **Score**  **6** |

## d) Unconformities are surfaces of erosion or nondeposition of sediments that separate younger rocks from older ones. The time gap in the rock record is known as a Hiatus, which results in an incomplete rock record. There are three types of unconformities. Briefly discuss the process of:

Disconformity

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| **Major Topic**  **Unconformities** | **Blooms Designation**  **AN** | **Score**  **6** |

**TOTAL SCORE: 25 MARKS**

**Question 7**

a) Soils contain three components, which may be characterized as solid, liquid, and gas. Discuss the characterization listed below which will enable a geotechnical engineering to conduct a good soil investigation for a major civil engineering project.

I. Solid components

II. Liquid component

III. Gas component

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| **Major Topic**  **Components of Soils** | **Blooms Designation**  **AP** | **Score**  **6** |

b) Industrial minerals and rocks are a group of naturally occurring, mostly non-metallic minerals and rocks, including materials of sedimentary, metamorphic and igneous rocks. Evaluate the importance of conglomerate in civil engineering.

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| **Major Topic**  **Importance of conglomerate in civil engineering.** | **Blooms Designation**  AN | **Score**  **7** |

c) Tectonic plates move very slowly relative to each other, typically a few centimetres per year, but this still causes a huge amount of deformation at the plate boundaries, which in turn results in earthquakes. Evaluate divergent: plates moving apart.

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| **Major Topic**  **Tectonic plates** | **Blooms Designation**  **AP** | **Score**  **6** |

d) In executing major civil engineering projects like road construction in the most convenient manner so as to accomplish the task ahead, enumerate the need for finding stable foundation of the projects.

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| **Major Topic**  **Finding stable foundation of projects** | **Blooms Designation**  **AN** | **Score**  **5** |

**TOTAL SCORE: 25 MARKS**

**Question 8**

a) Chemical bonds allow the atoms to achieve a more stable electronic configuration. There is an optimal number of electrons on the outermost shell which can be achieved through chemical bonds. In a precise manner, analyse the role played by an atom in the area of mineralogy

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| **Major Topic**  **Played by an atom in the area of mineralogy** | **Blooms Designation**  **AP** | **Score**  **7** |

b) As a civil engineer employed by a mining or civil engineering firm, analyse the importance following sediment properties in the application and construction of civil and construction engineering projects such as roads and harbour:

I. Consolidation

II. Cementation

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| **Major Topic**  **Sediment properties** | **Blooms Designation**  **AN** | **Score**  **7** |

c) In comparative analysis, evaluate the processes involved in breaking rocks into smaller pieces in order to use for construction purposes:

I. Mechanical weathering

II. Chemical weathering

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| **Major Topic**  **Comparative analysis of weathering** | **Blooms Designation**  **AP** | **Score**  **6** |

d) Geology is the scientific study of the earth and especially the rocks and soils that make up the earth: their origins, nature and distribution, and the processes involved in their formation. Briefly discuss how geologists conduct their research into processes involved in their formation.

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| **Major Topic**  **Geological investigations** | **Blooms Designation**  AN | **Score**  **5** |

**TOTAL SCORE: 25 MARKS**

**PART C [EVALUATING AND CREATING]**

**INSTRUCTIONS: Part C contains TWO questions. Answer ONE question.**

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**Question 9**

1. Rocks are form in a variety of ways in nature and are broadly classified into three groups based on their process of formation. Discuss the following rock types:
2. Sandstone

II. Rock salt

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| **Major Topic**  **Rock types** | **Blooms Designation**  **CR** | **Score**  **7** |

1. Physical geology is important to engineers as it involves the study of minerals, their formation, analysis, association, and classification. Discuss the importance of iron ore as an economic benefit of a country.

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| **Major Topic**  **Importance of iron ore as economic benefit** | **Blooms Designation**  **EV** | **Score**  **7** |

1. Mechanical weathering provides fresh surfaces for attack by chemical processes, and chemical weathering weakens the rock so that it is more susceptible to mechanical weathering. Discuss the observation made when rocks are exposed by weathering.

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| **Major Topic**  **Expansion of rock volume** | **Blooms Designation**  **CR** | **Score**  **6** |

d) During the weathering process the translocation of disintegrated or altered material occurs within the immediate vicinity of the rock exposure, but the rock mass remains in situ. Analyse hydrolysis process in chemical weathering.

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| **Major Topic**  **Hydrolysis process in chemical weathering** | **Blooms Designation**  **EV** | **Score**  **5** |

**TOTAL SCORE: 25 MARKS**

**Question 10**

a) Plate Tectonics provides a single unifying theory for understanding the dynamics of earth as everything about earth is mostly related either directly or indirectly to it. Briefly explain continental drift in physical and structural geology.

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| **Major Topic**  **Continental drift in physical and structural geology** | **Blooms Designation**  **CR** | **Score**  **7** |

b) A fault is a fracture or zone of fractures between two blocks of rock and often allows the blocks to move relative to each other. This movement may occur rapidly, in the form of an earthquake - or may occur slowly, in the form of creep. Discuss normal or dip-slip faults.

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| **Major Topic**  **Analysis of faults** | **Blooms Designation**  **EV** | **Score**  **7** |

## c) Few decades ago, it was believed that continents and ocean basins were fixed and permanent features and that the Theory of Continental Drift was just a radical idea (Hallam, 1973). Discuss the theory of continental drift.

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| **Major Topic**  **Theory of continental drift** | **Blooms Designation**  **CR** | **Score**  **6** |

1. Volcanism is the eruption of magma at the surface of a planet and rocks produced by volcanic processes are called volcanic rocks. The most prominent feature of volcanism is the volcano, an accumulation of volcanic material. Discuss the process of volcanism.

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| **Major Topic**  **Volcanism** | **Blooms Designation**  **EV** | **Score**  **5** |

**TOTAL SCORE: 25 MARKS**

**END OF QUESTION PAPER**